Contract DABT60-00-D-1001
Delivery Order 2

U.S. Army Signal Center and Fort Gordon Information Technology and Digital Training Masterplan

Prepared for:
USASC&FG
Ft. Gordon, GA 30905

Prepared by:
Research Triangle Institute

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Executive Summary

1.0 Introduction

This report describes work completed by the Research Triangle Institute to develop an Information Technology and Digital Training Masterplan that links the USASC&FG's mission and the Commandant's intent with a concept of operations for performing the School's responsibilities, now and in the future.

2.0 Information Technology and Digital Training Masterplan Roadmap

University of Information Technology: Establish the University of Information Technology to provide technology assisted lifelong learning and 24/7 reach back for signal and information technology soldiers and leaders, and to facilitate and foster lifelong professional and personal relationships. The University should include remote campuses, relationships with academia and degree accreditation programs, and sponsor education and training research and publications that include award recognition programs.

Education and Training Model: Adopt a phased, assignment oriented Education and Training Model to get trained soldiers and leaders to the field faster and to support follow-on assignment training.

Conduct *pilots* of the Education and Training Model to obtain data and lessons learned. Candidate pilots include: assignment oriented training (MOS 31S, 31R and/or Officer Advanced course), increase use of interactive PC based simulations for "learning by doing, expanded COTS training (MOS 53), trading off equipment for simulations (Smart-T) and assignment oriented training for follow-on assignments.

Simulations: Adopt PC based, interactive simulations as the basis for "learning by doing"; use the Integrated Training System Analysis Model to develop a family of technical and tactical trainers with simulations to provide better education and training at less cost at the University and other locations. These simulations should complement existing training content and focus on what is required/needed for training. The design should be COTS, support training for different MOSs, use at other locations, and include growth to new capabilities. The trainers should include a common architecture for reuse.

Managing the Implementation:

- Form an *Executive Steering Committee* to provide masterplan implementation oversight. The members should include the USASC&FG Command Group, University, reserve components, Signal unit leaders who understand the vision, potential, and are responsible for its success. The Committee also may include representatives of academia and industry.
- Form *Implementation Task Forces* to prepare Implementation/Action Plans. These action plans should identify actions to be accomplished; role, concerns and issues for external units, organizations and agencies; assign lead and supporting responsibilities and milestones for completion. In addition to the USASC&FG and its schools, these Task Forces should include representatives from the reserve components, remote sites such as Ft Hood and Ft Lewis, and major Signal units, organizations, and agencies to develop "real" partnerships beyond Ft Gordon.

Funding: Funding requirements are expected to be exceed current budget and program levels and require a well prepared, coordinated plan with integrity, that is supported by the Command Group to secure additional funding. The Implementation Task Forces should be creative for including "outside the box" funding in the action plans. Some action items such as sponsoring research and publications with award recognition may be possible with local approval for little or no cost. It also may be possible to redirect existing funding with internal changes to the current way of conducting business. Other possible funding sources are included in Section 6.2.3 of the research report.

3.0 Summary

The Information Technology and Digital Training Masterplan revolutionizes education and training for signal and information technology soldiers and leaders. The masterplan is a roadmap for a long term effort that should proceed in bite size chunks as technologies and methodologies mature and become available, as funding and other resources become available, and as the culture evolves to embrace it.

Table of Contents

PREFACE

The Research Triangle Institute (RTI) completed the research described in this report for the US Army Signal Center and Fort Gordon (USASC&FG) as Delivery Order 2 under TRADOC Acquisition Center contract DABT60-00-D-1001, *Doctrine Development, Training, and Training Products*.

The deliverable for this research is an information technology and digital training masterplan that links the USASC&FG's mission and the Commandant's intent with a concept of operations for performing the School's responsibilities, now and in the future. This masterplan provides guidance for implementing the concept of operation, to include information for teaching courses in each resident training department and regional site(s) or location(s) where signal and information technology training is currently conducted and/or should be conducted.

The masterplan is in sufficient detail for:

- Explaining it to, and obtaining support, of HQ, Department of Army and the HQ, U.S. Army Training and Doctrine Command's leadership and staff, as well as key external organizations and individuals.
- Providing guidance for developing detail design and implementation plans, as funding becomes available.

RTI performed the following tasks for completing this research:

Task 1: Prepare a work plan for completing this work.
The RTI technical lead for completing this work is Dr. Robert F. Helms II. Dr. Geoffrey A. Frank and Mr. Raymond J. Morris also supported and contributed to the research. This Team developed and presented a workplan for completing the work at a Project Kickoff meeting at the USASC&FG on 23 and 24 April 2001. This kickoff meeting was used to discuss and modify the workplan as necessary to align the research plan and USASC&FG needs and expectations.

Task 2: Develop a life long learning approach for the USASC&FG to fulfill its education and training missions, now and in the future.
In completing this task, RTI developed a life long learning model that enables the USASC&FG to fulfill its education and training missions, now and in the future. This model is consistent with:

- Learning approaches described in *Army Learning & Training Effectiveness Symposium Final Report*, dated March 30, 1999.
- Learning approaches being adopted by universities and colleges
- Resources and worldwide mission requirements of the Signal Community
- Needs and expectations of Signal solders and leaders in the information age Army.

Task 3: Determine Level 1 requirements for implementing this learning approach.
RTI identified and provided a listing of Level 1 requirements necessary for implementing the recommended lifelong learning approach. These requirements include recommendations for developing content that can be used at USASC&FG and in the field environments for acquiring

and sustaining the skills of Signal soldiers. These requirements provide USASC&FG a baseline for further analyses and definitions for budget forecasts and resource allocations.

Task 4: Develop proposed manning skill requirements and strategies
RTI developed and provided the USASC&FG a set of level 1 recommended manning or staffing skill requirements. These requirements identify the types of skills required for implementing the information technology and digital training masterplan. It also describes strategies for preparing and transitioning the USASC&FG staff and faculty to the lifelong learning environment. It also recommends strategies for recruiting and retaining the skilled personnel required for successfully transitioning to, implementing, and sustaining the masterplan.

Task 5: Develop a ROM Cost Estimate.
RTI developed and provided ROM cost estimates that can be used by the USASC&FG for developing resource requirements and budget forecasts and allocations for implementing the masterplan.

Task 6: Determine and document linkage to doctrine
RTI provided input to the USASC&FG for documenting linkages with existing and emerging tactics, techniques and procedures. This input addresses issues raised by the conversion from analog to digital systems and the requirement for supporting of hybrid analog and digital units as well as the presence of both analog and digital systems.

Task 7: Prepare a level 1 phased masterplan.
RTI integrated and used the data and information obtained in Tasks 2-6 to prepare and provide the USASC&FG a level 1 masterplan. This masterplan is a framework that is in sufficient detail to provide the USASC&FG a baseline and point of departure for gaining consensus and support for implementation. The masterplan is envisioned to be a living document that can and should be continually updated as it is implemented and as additional information becomes available. It also is flexible enough to provide future Signal leaders and commanders the opportunity to influence its implementation within the framework of the overall masterplan.

Task 8: Develop a road map for implementing the masterplan.
RTI developed and provided the USASC&FG a set of recommendations that provide a roadmap for implementing the information technology and digital training masterplan.
This research report is organized in an Executive Summary and seven sections:

Section 1: Situation
Section 2: Mission
Section 3: Execution
Section 4: Service Support
Section 5: Command and Signal
Section 6: Road Map
Section 7: Summary

In completing this work, RTI applied and adapted its experience for other similar masterplans and research for education and training that include:

- WarLab XXI, Ft. Leavenworth, KS

- Advanced Experimental Environment (AEE), Ft. Sill, OK
- Technical Advanced Learning Environment (TALE), Ft. Knox, KY
- Ordinance School Electronic Classroom, Aberdeen Proving Grounds, MD
- MLRS Advanced Maintenance Training Environment (AMTE), Huntsville, AL
- Advanced Learning in Interactive Virtual Environment (*ALIVE*) facility at RTI's main campus, NC
- University of Mounted Warfare (UMW) Level 1 design, Ft. Knox, KY,
- Apache Longbow Maintenance Training Study, Ft. Eustis, VA
- *Army Learning & Training Effectiveness Symposium Final Report*, dated March 30, 1999.
- *Army Learning and Training Symposium II (Collective) Final Report,* dated January 9, 2000
- Maintenance Training Requirements for the Bradley Fighting Vehicle
- Digital Training Facility Level I design, III Corps & Ft. Hood, TX

1.0 SITUATION

The information age and the transition of the force to information age technologies are placing new and increased requirements on communication systems and networks. The operational demands on signal and information technology are increasing with the introduction of new systems designed to operate over an expanded battlespace that includes the use of military forces that range from operations other than war to strategic warfare. The number of communication based systems and networks are increasingly dramatically. This trend line is expected to continue with U.S. military forces seeking to leverage technologies to realize "Information Dominance" as a major warfighting component. The infusion of new technologies and the increasing use of Commercial-off-the-Shelf (COTS) products are taking place side by side with the continued operations of legacy systems, resulting in a mixture of old and new for the foreseeable future that further complicates the training challenges facing the USASC&FG. The increased numbers of systems and the rapid infusion of new technologies are making it even more difficult for the schoolhouse to pay the cost of maintaining its equipment for training. Furthermore, the schoolhouse continues its struggle to acquire new equipment for training.

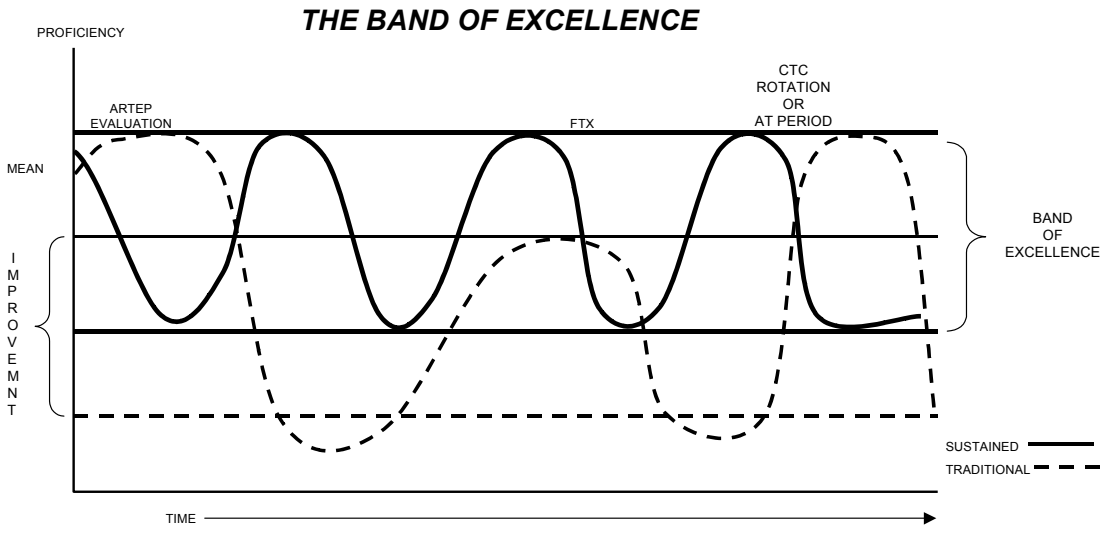
The role of leaders, operators, maintainers, and network administrators of communications based systems and networks is becoming increasingly critical to battlefield success as the force continues its transition to increased reliance on information age technologies. The 3 May 2001 III Corps Digital Training Seminar explored the possibility of these personnel being recognized as "Key Personnel" and being identified with an Additional Skill Identifier. This Seminar also described the concerns of tactical commanders for the increasing complexity of information systems and networks with the continuing infusion of information age technology software. It is widely recognized that the skills required are perishable and must be continuously refreshed to maintain the proficiency levels of personnel operating signal and information technology systems and networks, including leaders who use the information produced by these systems for battle decisions.

The Army's plan to digitize the battlefield has changed and is continuing to change the environment as wells as the way the Army fights. These changes include increasingly complex and costly communication systems; training for a system of systems; exporting learning; and, infusing new learning approaches, technologies, and commercial best practices for a new generation of students, while managing resources that continue to be severely constrained.

The individuals assigned to signal and information technology positions are soldiers who operate and maintain systems and networks. They have to be skilled in the operation and maintenance of these systems and networks, and the protection and fighting of them. Consequently, the education and training for these personnel must represent a balance mix of the ***science*** of operating and maintaining the systems and networks as well as the ***art*** of employing and fighting them.

The USASC&FG cannot expect to meet the growing demands for signal and information technology soldiers and leaders by increasing the education and training infrastructure of the schoolhouse to a level that meet these demands while continuing "business as usual". The complexity of the hardware, software and operating procedures of the systems and the networks is resulting in longer resident courses. The increased length is requiring soldiers and leaders to spend an unacceptable length of time in the formal schoolhouse to graduate with the skills required for operating and maintaining them. Furthermore, the student skills learned during the early part of the course likely will have suffered considerable decay by the time he or she reaches the unit of assignment. The traditional model of a student returning to the schoolhouse is becoming less of a viable option and would result in unacceptable violations of the Band of Excellence. The learning of new skills required by rapid changes of technology and the frequent refreshing to counter the perishable nature of the skills for operating the systems and networks would require the soldier and leader to be away from the unit an unacceptable amount of time. It also would be very costly over an extended time period.

However, the USASC&FG can take advantage of available lifelong education, training, and distribution technologies and methodologies to fulfill its responsibilities for maintaining its soldiers and leaders and the units in which they serve within the Band of Excellence described in FM 25-100, Training the Force, and illustrated below.



It is now necessary to change the way soldiers are trained. Available lifelong education, training, and distribution technologies and methodologies enable the USASC&FG to:

- Provide access for its soldiers and leaders to education and training materials and information delivered on-demand at the individual's location
- Formally include individuals at other locations as students with the same rights and privileges as individuals located at Ft Gordon
- Establish and support a network of remote campuses such as at the digital training centers being established first at III Corps, Ft Hood TX and later at other locations to provide on-site instructor led education and training. These campuses could include instruction being presented by instructors from other remote campuses or Ft Gordon.

In the process, the presence and influence of the USAS&FG is extended beyond the physical boundaries of Ft Gordon to wherever there are soldiers and leaders participating in education and training, and/or using the available information.

2.0 MISSION

The mission of the USASC&FG is to train communications systems and information technology to Signal soldiers and leaders Army wide. The USASC&FG also is the executive agent for 29 inter-service and joint communications courses. The fulfillment of this mission enables the USASC&FG to:

- Provide highly trained soldiers, leaders and organizations to achieve information superiority for the full spectrum force
- Provide and manage a seamless, protected, survivable, integrated and dynamic information service
- Acquire and integrate relevant information technologies and related doctrine into the force

3.0 EXECUTION

3.1 Concept of Operations

The USASC&FG will build on and integrate existing personnel, materials, methods, facilities, and infrastructure with emerging technologies, methodologies and evaluations to provide lifelong learning for the Signal and Information Technology force.

3.1.1 Commander's Guidance

The USASC&FG will fulfill its responsibilities to soldiers, leaders, and units, to include joint and combined training. The soldiers and leaders will arrive at their units trained. The training will include the full array of legacy, digital and COTS systems and networks required for fighting and winning on hybrid battlefields with digital and analog systems. The USASC&FG will strive to put trained soldiers and leaders in the field faster.

In accomplishing this guidance, the USASC&FG cannot be tied to the current way of doing business. We have to and will update and change our approaches, as appropriate, to accomplish our mission. Our actions must include establishing a partnership with units for putting plan into place and be consistent with TRADOC Transformation Strategy, as well as other Army and joint initiatives.

3.1.2 Commander's Intent

The Commander's intent is for the USASC&FG to:

- Perform its mission, now and in the future with the leveraging of education, training, and distribution technologies and methodologies to:
  - Provide realistic, better learning at less cost
  - Support on-site training and materials on-demand for soldiers, leaders, and units
- Establish 24/7 reach back to the USASC&FG
- Become the "Center of the Universe" for lifelong learning and information for signal and information technology soldiers and leaders, to include alumni
- Organize the University of Information Technology to provide lifelong 24/7 learning and support for signal and information technology soldiers and leaders

3.2 Execution of Commander's Intent and Guidance

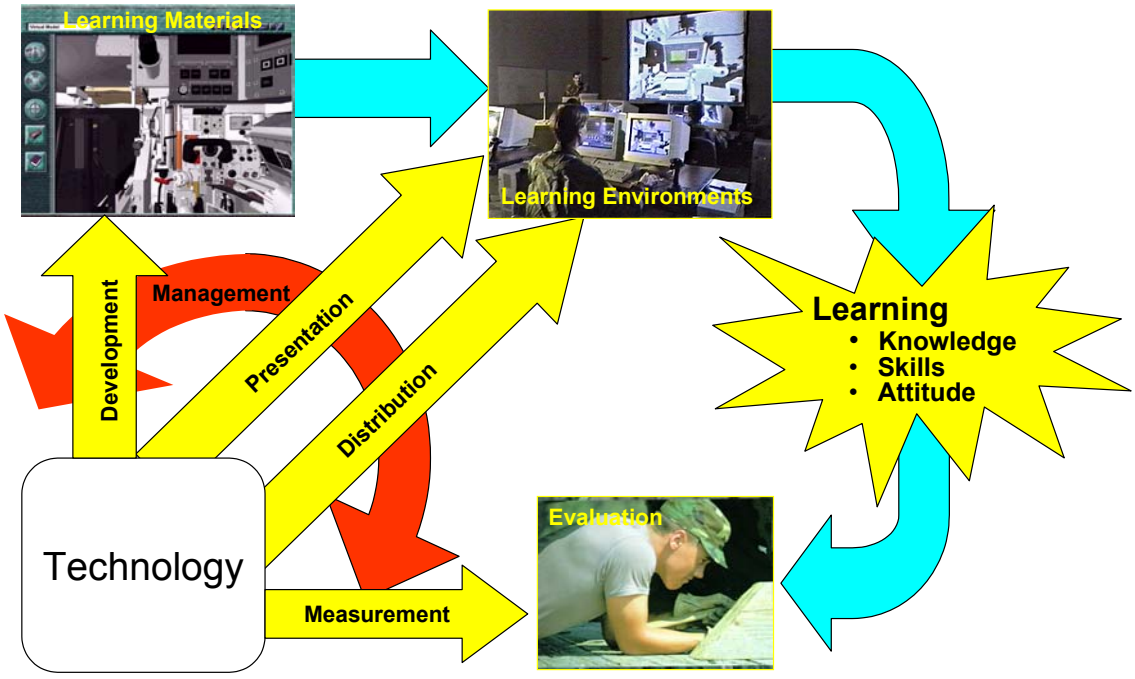
3.2.1 Learning Model

This research examined a number of learning approaches and recommends the Technology Assisted Lifelong Learning as the optimal approach for meeting signal and information technology education and training needs, now and in the future. This model, illustrated on the following page, was developed at the Army Learning & Training Effectiveness Symposium conducted 23, 24, and 25 February 1999 in Hampton VA, and recommended for adoption in RTI's Symposium Report, dated 30 March 1999. This

model is applicable and can be adapted to meet USASC&FG education and training requirements.

The lifelong model includes a mixture of traditional schoolhouse resident instruction as well as instruction presented at other locations. The location of the instruction becomes progressively less relevant as the learning approach matures and the Army culture evolves to accept it. As the student advances in experience, rank and responsibilities, the education focus is less on knowledge and basic skills to more on attitudes and strategic skills required for accessing and using technology assisted learning materials just-in-time and on-demand at the individual's location.

Technology Assisted Learning Model



The model is a coherent learning approach that provides customer-focused, technology assisted lifelong learning for the information age force. This approach considers all members of the signal and information technology force, to include civilian employees, to be engaged in lifelong learning wherever they are located. It is a total approach that includes instruction and materials delivered in synchronous and asynchronous modes, just-in-time, on-demand, and adapted to students involved in formal school programs and courses as well as practical day-to-day duties and activities. A primary goal of lifelong learning is to minimize the differences in learning that takes place in the schoolhouse and other locations; and, in fact, implements instruction using the most cost-effective mix of locations, materials, and methods.

The technology assisted lifelong learning approach for education and training:

- Is consistent and complementary with industry and academia

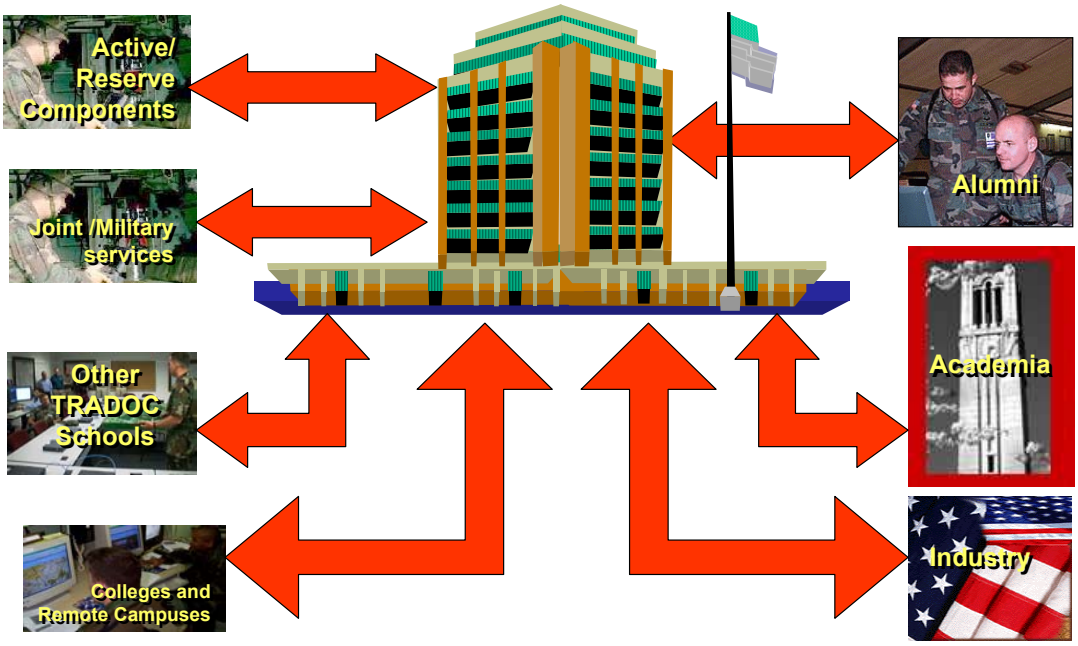
- Integrates and leverages information age technologies, advanced education and training methodologies and technology supported evaluation practices
- Includes procedures to validate learning
- Uses computer-based IMI and simulations technologies to support training requirements for technical and tactical training

Lifelong learning "represents a real change" in the way business of education and training is conducted. The approach impacts the relationship of the schoolhouse and student. The schoolhouse accepts and assumes the same responsibility for students at all locations which impacts the design of training materials, the focus and responsibilities of staff and faculty, student records, funding allocations, and other factors associated with learning and certifications of students. It also requires that students accept and assume higher levels of personal responsibility for their education. Distance learning and web based education and training materials are tools of lifelong learning (are subsets of lifelong learning).

3.2.2 University of Information Technology

The research recommends the USASC&FG establish the University of Information Technology. This University would provide technology assisted lifelong learning, materials, information, and support that includes 24/7 reach back for the signal and information technology community, to include active and reserve components, other military services, joint commands and agencies as well as alumni. In this way, the University can be expected to facilitate and foster lifelong professional and personal relationships to become the "Home" university for signal and information technology soldiers, leaders and their families, to include alumni. The University should have the same responsibility for all students, regardless of their location and it must eliminate any differences between students located at Ft Gordon and other locations; all of its students will be the same. As shown in the following figure, the University components include colleges derived by transitioning the USASC&FG schools to this status and establishing a network of remote campuses, and relationships with commercial training sites, units, armories, and individual homes. They also can include other components such as academic and research organizations that are supporting the education and training needs of the University. The remote campuses can be established at locations with special needs and/or high densities of signal and information technology soldiers and leaders such as III Corps Ft Hood TX, XVIII Corps Ft Bragg NC, and Ft Lewis WA.

The University of Information Technology



The University of Information Technology prepares students for planning, designing, operating, maintaining, protecting and fighting signal and information technology systems and networks that are highly technical and complex. The required skills are essential for realizing "Information Dominance" as a warfighting component that tilts the battlefield in favor of U.S. military forces. These skills are unique to different assignments; e.g., an assignment to a tactical Army unit, a unit with a strategic mission or TDA and joint organizations.

The technologies and COTS that signal and information technology soldiers and leaders are integrating and employing are part of the Information Revolution that includes a rate of development and change that is unparalleled in history. These soldiers and leaders have to simultaneously operate, maintain, fight the current systems and networks, and introduce and integrate new technologies and COTS into the force; an example of this phoneme is the digitization of III Corps forces at FT. Hood TX. These skills represent a higher order of magnitude in complexity, they are perishable and they have to be continually updated due to the rapid insertion of new technologies and COTS in signal operations. They also are highly desirable in the civilian work force and, once they are obtained, provide signal and information technology solders and leaders a viable alternative to continuing their military service. As a result, the Signal branch of the army has to deal with a higher level of turnover in key technical positions. This turnover imposes an even greater student throughput requirement on the Signal School. The just-in-time training approach of technology-assisted lifelong learning recognizes this situation and uses assignment –oriented training to mitigate this problem.

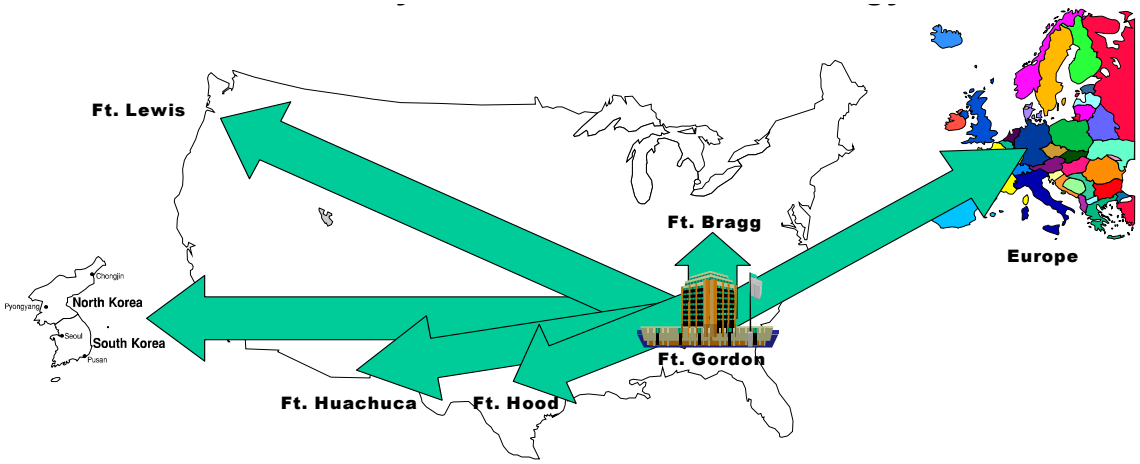
The University of Information Technology education, training and materials support keeping signal and information technology soldiers, leaders and units within the Army

doctrinal Band of Excellence prescribed in FM 25-100, *Training the Force*. It is tasked to get trained soldiers and leaders to the field faster; to provide education, training, and materials for sustaining the skills; and, for acquiring the new skills necessary for follow-on assignment to different organizations. As described earlier, the location of where the skills are acquired and sustained is becoming increasingly irrelevant as the University's presence and influence moves beyond Ft Gordon to worldwide, global status.

3.2.2.1 Remote Campuses

The realization of technology assisted lifelong learning with multiple components includes a network of remote campuses and students at other locations to expand the University's presence, active involvement and influence to a worldwide, global status. These remote campuses can represent a major step forward in taking lifelong learning to the student. The remote campuses complement education and training delivered by distance learning methods to provide a range of options for the student. In the process, the system is making education and training more accessible to a larger number of students, resulting in better-educated and more productive population. The University model, with remote campuses and other relationships, parallels university systems across the nation (e.g., the University of North Carolina system) for delivering instructor led education and training to locations with concentrations of student populations. The same logic is applicable for the students of the University of Information Technology, who mirror many of the same characteristics as the civilian student population, particularly those pursuing technical degrees.

The University of Information Technology uses Remote Campuses to bring training to the troops



3.2.2.2 University Customers

The population for lifelong learning extends beyond the boundaries of USASC&FG to include all ranks and specialties of signal and information technology military and civilian personnel, globally deployed. While there are differences in abilities to work with technologies; in general, these individuals:

- Are more diverse and more comfortable with technologies than previous generations
- Learn best when they know what they are accountable for, how they fit into the mission, and when they are confronted with real life situations (trainable moment)
- Are comfortable learning as a member of a team and respond well to peer reviews
- Are able to develop various levels of social relationships during the use of communications networks such as the Internet.

Just as industry must satisfy its customers to be acceptable, the education and training methods adopted by the University must be consistent with the expectations and needs of its customers, the lifelong signal and information technology student. These methods should support individual creativity, team collaboration, peer review, and instructor led education. They should take advantage of the increased effectiveness realized from the interactions and collaboration among students and instructor led instruction. Technologies can and should be used to maintain satisfactory levels of the learning effectiveness that results from student-instructor interactions, even for students at other locations.

Those students who are motivated are good candidates for technology assisted learning materials and methodologies. The University will need to:
- Identify student responsibilities for technology assisted lifelong learning
- Ensure students understand and accept these responsibilities
- Ensure students are prepared to use the technologies and materials
- Identify incentives and disincentives that motivate lifelong students to successfully complete technology assisted learning and to routinely use these materials as a regular part of their everyday real life experience.

3.2.2.3 Faculty

The colleges of the University can continue to use the current staff and faculty to teach the programs of instruction for students located at Ft Gordon. However, the instructor's role whether located at the USASC&FG or remote campuses as well as first line supervisors should evolve in the general direction of a facilitator. Selection criteria and training are needed for instructors to ensure they are able to be effective facilitators, to include working with students at other locations. Simulations and technology based aids such as intelligent coaching and tutorials support the instructors to minimize the impact of effectiveness lost because of fewer face-to-face student-instructor interactions. The University should ensure a burden for using the technology is not placed on the instructor at the expense of this individual being first and foremost a qualified teacher. Realizing this goal requires that technology based Resource Centers be established and made available to provide this support, to include scheduling and coordinating students and instructors interactions.

3.2.2.4 University Sponsored Research and Publications

The signal and information technology community operates in a set of new environments that are just now starting to unfold. The level of unknowns for their impact on warfare

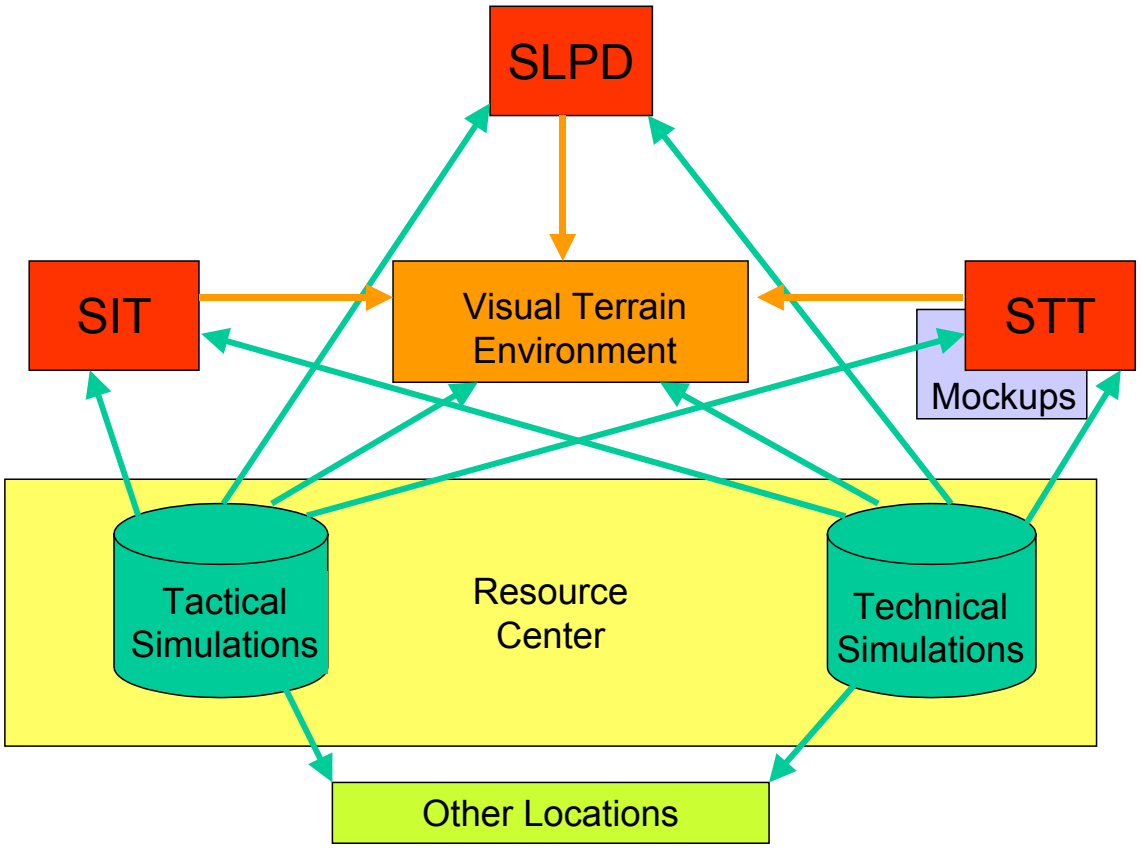
represents a rich area for research, serious thought, and publication by members of the community for gaining increase levels of professionalism. The applications of this research extend beyond military applications to include academia, commercial and civilian sectors. These applications are considered to be comparable to the historical model of the military leading the way for sponsored research in new areas such as medicine and aviation; information technology is now one of these new areas.

This research strongly recommends the University become a serious sponsor of programs for research and publications. It is envisioned the University will quickly become nationally and internationally recognized as a Center of Excellence for Signal and Information Technology. The University should strive to establish relationships with academia, research centers, and degree accreditation programs to build its stature for serious research, thought, and publication. This path should include aggressive support and association with research that furthers the base of knowledge and the applications of this knowledge for signal and information technologies. The University and its colleges can establish and sponsor program to recognize and reward research and publications of its constituencies as a way of increasing their involvement in its activities.

3.2.2.5 Simulation Resource Center

This research recommends the University establish a Simulation Resource Center (SRC), as illustrated in the figure below. The University of Information Technology will be adding to the current set of USASC&FG simulations as it develops the trainers and simulations recommended in this report. The end result will be even more significant requirements for establishing, maintaining, and managing software databases. It is envisioned that software for the recommended suite of trainers and simulations will reside primarily on local PCs for everyday instructional purposes and would be available on-demand from a central database location. This central location also would be responsible for configuration management and updating software to maintain currency with changes. The simulations are designed for distribution to standard PCs. The simulation software is easily replicated, so that any number of users can be getting the training at the same time. This wide use may reduce some of the scheduling problems now facing USASC&FG, where a focus on technical AIT training could mean leadership training must be scheduled so access equipment and/or Hands-On Trainers occurs in off-hours. As the figure illustrates, the SRC supports all the University colleges. The SRC will manage and schedule a Visual Terrain Environment (VTE) for tactical simulations. The many uses of the VTE include replacing traditional map exercises with virtual terrain as well as orienting satellites and line of site communications equipment. These kinds of training occur across the University. The colleges would continue to maintain their equipment mockups and hands-on trainers.

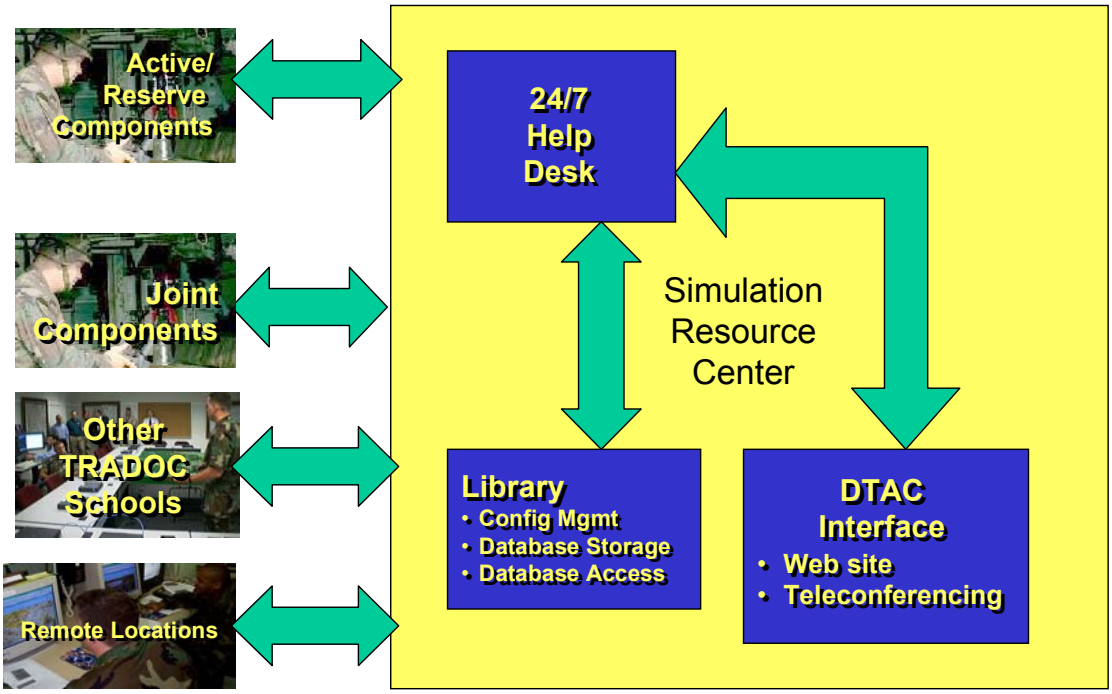
The Simulation Resource Center is the central facility for maintaining and distributing University of Information Technology simulations



The figure on the following page illustrates the key elements of the Simulation Resource Center:

- A digital library supports the simulation, stimulation, and scenario databases required for training. The library will also provide links to information about new information and communication technologies, and data on lessons learned by the signal and information technology community.
- A 24/7 Help Desk will be a key element for helping individuals at other locations, to include alumni access information at the University. The help desk will direct calls to individuals who can assist in configuring simulations, stimulations, and scenarios to meet unit training needs as specified by unit MTP.
- The DTAC Interface will provide a mechanism for distributing University training content across the Internet. The DTAC interface will ensure that University's training materials are maintained in a manner consistent with TRADOC policy and coordinated with the Reimer Digital Library. The SRC will coordinate video teleconferencing through the DTAC as a means for providing real-time interactions between University leaders, staff and faculty with soldiers and leaders.

Simulation Resource Center Components



Simulation Resource Center Functions: The Simulation Resource Center (SRC) should perform services that include:

- Providing technicians for simulation, responding to trouble calls, evaluating and analyzing compatibility with supported computer configurations and providing and implementing solutions to reported and discerned problems.
- Performing component administration responsibilities to include simulation software distribution, configuration, and operation, managing computer memory/disk storage to include maintenance of hard disk space allocation.
- Providing and implementing recommendation(s) on system changes and operational procedures needed to increase efficiency, maintaining record copies of system/component software disks and documentation and performing all duties in accordance with DOIM guidelines and regulations.
- Managing University student networks servers for centrally administered courses
- Managing University student and instructor accounts
  - Ensure that the servers are operational
  - Perform backups on servers
  - Work with DPW and DOIM to ensure that the server operating environment is within limits required by server maintenance agreements
  - Perform preventive maintenance on the servers
  - Upgrade the server configurations as authorized
  - Issue logins and passwords.
- Providing backup for student simulation software and training scenario data
- Managing/maintaining software licenses
- Managing the software maintenance agreements

- Installing software upgrades

The University SRC should maintain a Government-provided documentation/reference library for University trainers and simulations. It should maintain network versions of application software to include loading and configuration management as well as a record of all copies of software disks and documentation. Additionally, the University SRC should maintain continuity of operations (Disaster Recovery) capabilities to include file server back up and restoring damaged/lost files/data as well as a training system troubleshooting, that includes:

- Compliance with designation of problem resolution priorities
- Based on resolution forecast (time/resources), advising and implementing problem resolution resource assignment (initial and buildup)
- Problem diagnosis
- Developing and implementing a repair strategy
- PC/workstation/peripherals that include component/operating system/network
- Software installation and configuration

It also is recommended the SRC operate the University's Help Desk providing 24/7 call back services support. This support includes:

- Responding to trouble calls, evaluating and analyzing compatibility with supported computer configurations, and providing solutions to reported and discerned problems.
- Referring technical questions about Army telecommunications and information systems to appropriate subject matter experts, staff and faculty.

The University SRC should maintain a daily work-order log and record in it all work orders. It is recommended that this log include verbal requests for assistance that are received from individuals encountered to/from service(s) calls being accomplished as a direct result of tasking by work order.

3.2.2.6 Access to Learning Materials

The reliable access to learning materials is critical to the University's success and it should use available distribution means to avoid delaying implementation; providing access is one of the primary functions of the University SRC described above. It is recommended that, in the near term, the University adopt the Internet as its distribution backbone for materials with networked distribution gaining prominence in the longer term; the CD-ROM can also be used as a convenient interim measure. The University should also explore the opportunities for partnerships to use existing networks such as those operated by academia, industry, states and nation-wide organizations for distributing materials. One of the basic design criteria for education and training materials should be consistency with available distribution capabilities; these materials can be made more complex as distribution capability increase.

There is no need to delay implementation of University technology assisted learning because high tech classrooms may not be available at all training locations. Indeed, the perceived and misguided requirement for high tech classroom has, in many cases,

become an obstacle to realizing learning when these classrooms have been established without associated content, resulting in costly infrastructure and pipes without the content required for learning. The University's goal is to develop content for education and training and to make this content accessible and available to the student on-demand, to include in individual homes if this location is the preferred choice. The priorities recommended for technology assisted lifelong learning are:

- Develop and make available the materials required to support this approach
- Adopt the Internet at the communications backbone of the University's lifelong learning approach
- Provide every signal and information technology soldier and leader access to the World Wide Web

The University should use the Army's Reimer Digital Library as well as the SRC simulation databases for storing and distributing its education and training products and materials. The colleges should have responsibility for managing the data at their local sites, but access to the material should be provided through the central University SRC.

3.2.3 University Education and Training Model

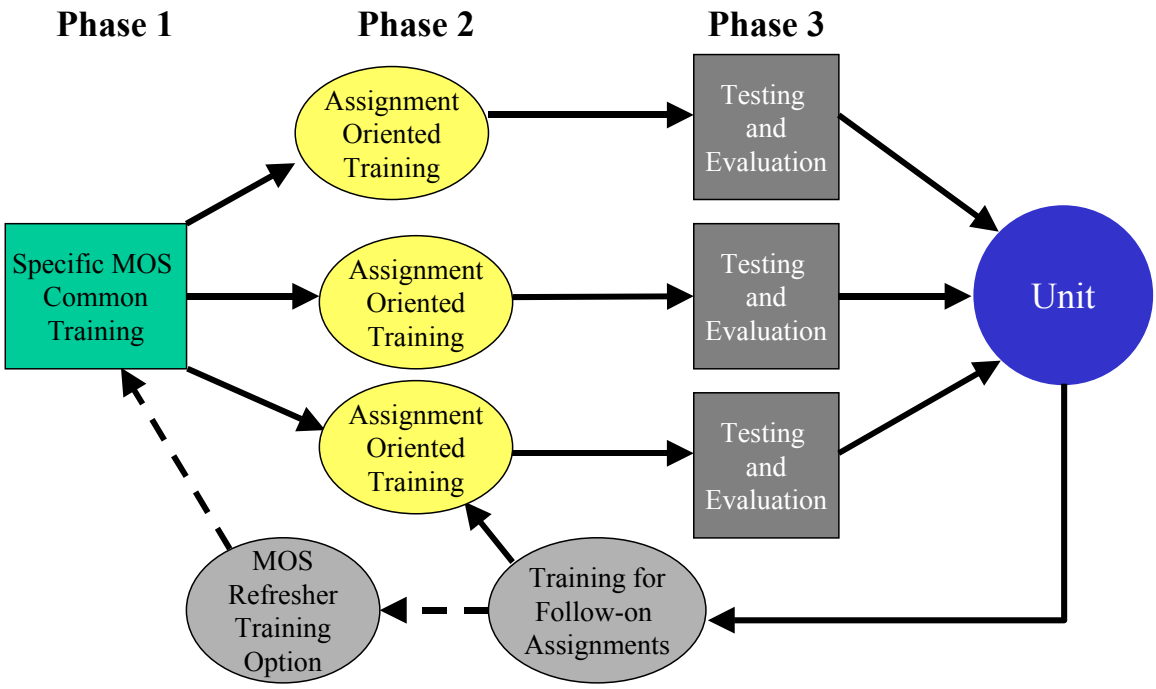
Given the burgeoning student throughput requirements facing the University, it is essential to adopt methods that will shorten the training time and get trained soldiers and leaders to the units faster. An key method for achieving this requirement is to leverage the potential for tracked training inherent in existing USASC&FG education and training, and use assignment oriented training to focus student training to the needs of their next assignments. The research estimates this approach could cut the time that a student is in school to approximately half, and at the same time provide the units with soldiers and leaders who have skills resulting from more focused training. The traditional drawback of this approach is the need for additional training when the soldier or leader is assigned to a different unit. However, new training methods and technologies are alleviating these drawbacks. The University also could provide training to prepare the individual for follow-on assignments and should focus on implementing methods and technologies that make assignment oriented training practical.

The research recommends the education and training model illustrated below for the University of Information Technology. This model includes three phases of training that are the responsibility of the University:

- MOS-Specific common training on theory and principles that are applicable to any of the assignment specific tracks for a MOS
- Assignment specific training for a particular track for the MOS
- Testing and validation of the training to ensure the student is ready to perform his or her duties in the unit.

The University also should support refresher training and cross-track training for soldiers shifting from one assignment track to a different track. The remote campuses and emphasis on technology assisted lifelong learning can be used to support this training.

University Education and Training Model



The rapid changes in technology normally will require some level of refresher training for follow-on assignments, even if the follow-on assignment is in the same track, and this model accommodates this need.

This education and training model enables the University to fulfill its responsibilities to the signal and information technology communities to:

- Train soldiers on the science of using the systems
- Train leaders on the science of using the systems and the art of planning, designing, establishing, fighting and protecting the systems and networks within the context of an operational plan
- Provide knowledge based training common to all signal and information technology soldiers and leaders
- Include education and training of theory and principles in knowledge based training. This training includes embedding and reinforcing theory and principles as part of MOS Specific Training at the "teachable moment"
- Include testing and evaluation to verify soldiers and leaders arrive at the unit trained
- Provide "Tracked" assignment oriented training tailored to follow-on assignments.

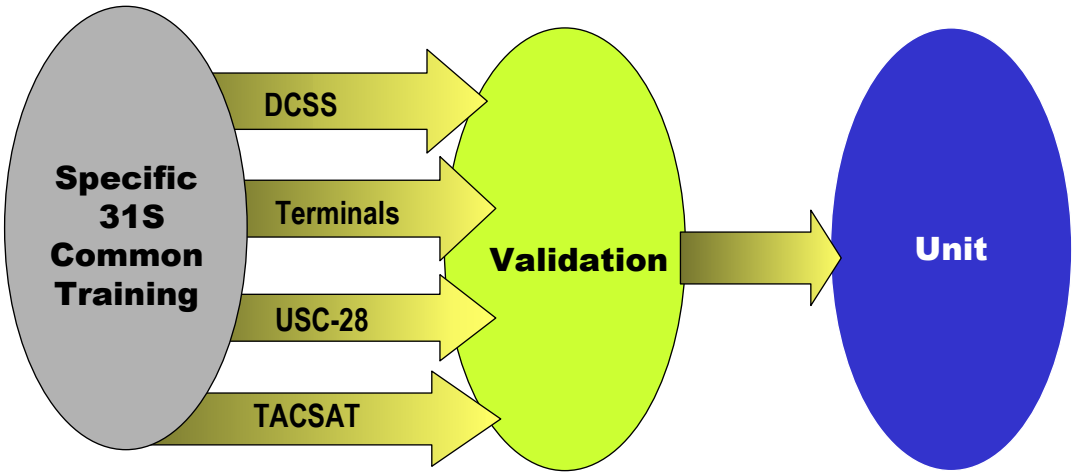
The education and training model is flexible. It does not assume one size fits all and can be tailored to meet the needs of individual MOSs, soldiers and/or leaders. These changes include those resulting from the continued insertion of new technologies and the adopting of new missions that impact signal and information technology soldiers and leaders. The model supports training of legacy, digital and COTS systems for an increased student throughput that can be expected as the Army, other military services, and joint commands and agencies continue fielding more communication and digital systems across the force.

The model puts soldiers and leaders in the field faster with knowledge of theory and principles and who have received training "tailored" to the unit assignment. The placing of trained soldiers and leaders removes the burden of assignment oriented training from units in the field and supports an improved partnership of the University and these units. The recommended education and training model is consistent with the TRADOC Transformation Strategy and O&O plan, as well as other Army and joint initiatives.

3.2.3.1 Assignment-Oriented Training

The following figure illustrates the use of tracks at USASC&FG in the 31S Satellite Communications Systems Operator/Maintainer AIT course. The current 31S-10 course has common training and then has the four tracks shown below. The current 31S-10 course lasts 35 weeks and 1 day. As the STAR-T system is added to the 31S responsibilities, the 31S-10 course will be increased to 41 weeks. Furthermore, 75% of 31S students go to tactical units and use their TACSAT training. With assignment-oriented training, the 31S-10 course for a TACSAT student could be cut in approximately half to get these soldiers to the field faster with the skills required, potentially doubling student throughput.

An example of course tracks adapted to assignment oriented training



Similar tracks occur in other parts of the University such as the Signal Officer Basic and the Signal Officer Advanced Courses. For example, the SOBC includes tracks for strategic equipment management training, tactical equipment management training, and S6 (TOC operations) training.

3.2.4 Education and Training Materials

The student population served by the University is expected to include a mixture of students located at the USASC&FG, remote campuses and other locations. The colleges will need to provide education and training materials, instruction and management for these students, and must prepare for these functions. Over time, the University can expect to teach fewer platform hours. However, these fewer platform hours do not

translate to fewer staff or less presence and influence in the signal and information technology community. The University is responsible for preparing technology assisted learning materials that enable the student to achieve competency for a complete set of critical tasks, as opposed to providing competency for a partial list of critical tasks. Where the student learns these tasks is becoming increasingly irrelevant.

The University and its colleges should be placed on a path that leads to being responsible for teaching skills that enable the student to access and use the appropriate information at the trainable moment. The University will continue to be responsible for developing and maintaining the common databases of instructional materials used by its student population. These materials should be developed in reusable modules that allow reusing them for just-in-time instruction at the trainable moment as well as for any unfulfilled competency training.

The University is also responsible for making these materials available for access by lifelong students located worldwide. This access to the same information should be common to active and reserve components, civilian personnel, and educational institutions. Changing the focus of the Colleges from platform instruction to supporting lifelong education and training that includes all USASC&FG constituencies can be expected to require changes in the organizational structures of these institutions and the formulas used for funding their activities.

The University continues to be responsible for designing and developing materials for the education and training of the student population worldwide. The materials should be developed using integrated technology based training system analysis methods, described later, that support learning by doing and meets the requirements of scientific discipline. These materials should be:

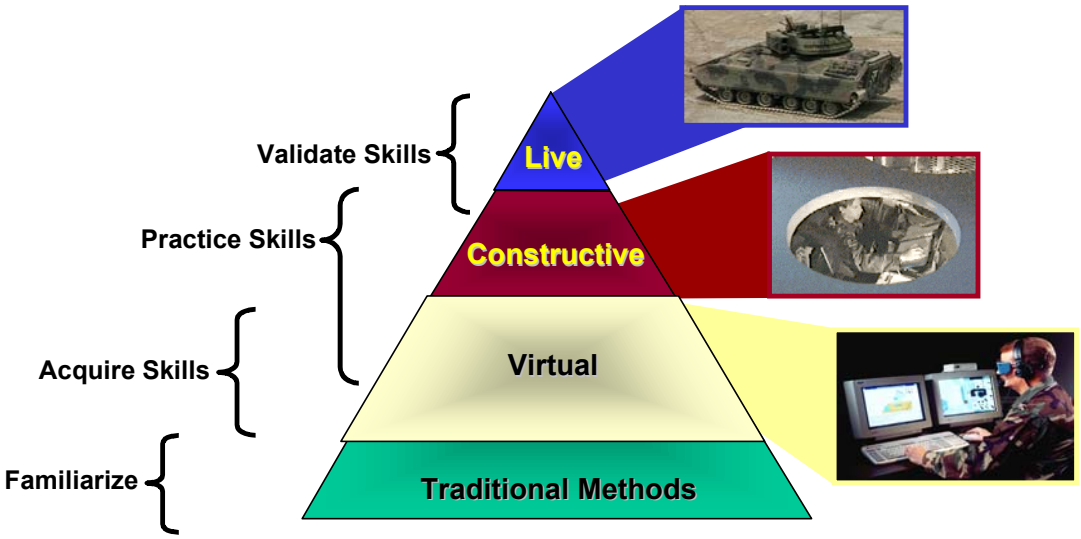
- Developed to standards that support users who do not have the benefit of instructors
- Consistent with student expectations and needs
- Usable with existing distribution capabilities, particularly the World Wide Web
- Developed to established standards to support reuse and dynamic reconfiguration of materials to match the needs of the student
- Scalable and flexible to support a range of education and training needs

3.2.4.1 Use of Simulations to Support University Education and Training

Our research concludes that signal and information technology soldier and leader tasks are extremely well suited for the use of simulators for training. Most of these tasks can best be acquired via “learning by doing”. They include heavily technical subjects that can be supported with PC based simulations and stimulation. The training triangle illustrated below is recommended for technology assisted lifelong learning at the University. It uses a mixture of traditional methods that quickly give way to interactive virtual and constructive environments with validation taking place in constructive and, when required, in live environments to achieve very cost-effective training. The rapid increase in the speed and graphics capabilities of personal computers supports the wider use of interactive simulations for training. The University is now able to export

simulations that provide effective learning as training material to remote campuses, to units in the field, as well as to individual soldiers, leaders, and alumni.

The Training Triangle

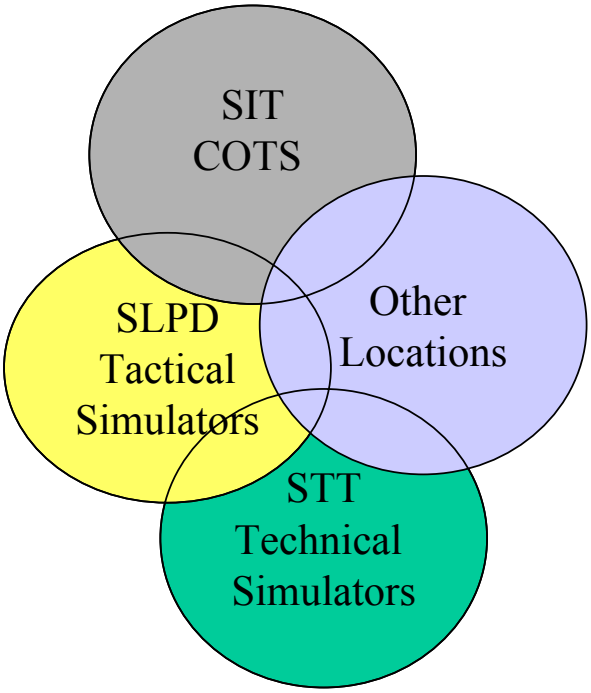


The simulations for supporting signal and information education and training can be grouped into the general categories of technical and tactical. The technical simulators provide training on the operation and maintenance of systems and networks (***science***) and the tactical simulators provide training for the planning and fighting the systems and networks (***art***). The use of software based technical simulations can significantly reduce the University's need for equipment items that are hard to obtain, costly to maintain, and become a choke point for student throughput. There may be some simulations that can be delivered by the Program Manager and be available to the University for training when the equipment is being fielded.

Both technical and tactical training can be implemented with simulations on personal computers. The tactics associated with planning, establishing, operating and maintaining the systems and networks do not require complex tactical simulations. Indeed, there are a number of existing military databases and simulations as well as COTS simulations that can support or can be adapted to meet many of the University's tactical training needs. The evolution of DIS and HLA protocols mean that Government tactical simulations (like JANUS or its successors OneSAF and WarSim) can be networked with specific simulations of communications systems. The explosion of LANs, WANs, and intranets in industry means that a number of COTS network performance simulations are available and can be adapted by the University. The use of COTS tactical simulations can present integration issues unless networks of different functions as well as different players are possible. Experience with the University of Mounted Warfare emphasizes that the use of tactical simulators must be driven by the educational mission of the course. This driver is particularly true for training combat support functions, where the overhead of operating the simulation can overwhelm the educational benefits achieved by the simulation.

Our research also determined there are significant levels of common use among the current schools at the USASC&FG, as illustrated below; this commonality is expected to also occur in the colleges of the University. In general, the School of Information

Common Use of Simulations



Technology instruction is focused on the use of technical simulators for teaching operators how to operate the systems with some instructional requirements of tactical simulations for teaching the tactics associated with their operations. The School of Leadership and Professional Development teaches leaders how to plan, establish and fight the systems and networks within the context of a tactical situation. This School does provide some technical training for its students to ensure they understand the operational and maintenance requirements of the systems and networks, but it is relatively limited. Overall, the instruction presented by the School of Leadership and Professional Development would be a heavy user of tactical simulations with significantly fewer requirements for technical simulations. The focus of the School of Information Technology is on the use of COTS for training information technology soldiers and leaders. It would use both technical and tactical simulations, but to a lesser extent than the other two Schools. Other locations that include remote campuses, units and individuals (active, reserve components, and civilians in the Army, other military services, joint components, and other nations) located away from Ft Gordon are users of technical, tactical, and COTS trainers and simulations.

The common use of simulations supports their design and development for multiple users and is a significant advantage in terms of cost. It allows the University to accomplish its

education and training requirements with fewer, more precisely defined simulations that can be used across its constituents.

3.2.4.1.1 Technical Simulations

Our research recommends the University develops and uses the technical and tactical trainers described below. These trainers can provide more realistic and better education and training at less cost at the University and other locations to meet its lifelong education and training requirements. Each of these trainers includes a family of simulations. The Echelon Above Corps Trainer and the Echelon Below Trainer are used to support operator, network, and maintenance training (science) as well as leader (science) training. The Integrated Digital Systems Trainer provides training (science) for the installation, operation, and maintenance of digital networks.

Technical Trainers	
Echelons Below Corps Trainer	**Echelons Above Corps Trainer**
AN/TTC-46	AN/TTC-56
AN/TTC-47	AN/TRC-138
AN/TTC-48	AN/TRC-170 (USAF only)
AN/TRC-190	AN/TRC-173
AN/TRC-191	AN/TRC-174
AN/TTC-50 (Ft. Bragg only)	AN/TRC-175
AN/TTC-51 (Ft Bragg only)	AN/TSC-85 & AN/TSC-93
AN/TTC-154 (SMART-T)	TD-1233, TD-1234, TD-1235 (Joint Training)
AN/TSC-156 (V) STAR-T (new system)	CV-4180 (Joint Training)
AN/VSQ-2C (V) 1 and AN/TSQ-158 (V) 4 (EPLRS System)	TTC-39D/PS/39D(V2) 2 Fundamentals
Integrated Digital Systems Trainer	
FBCB2	TAIS
MCS	SINCGARS/INC
CSS-CS	EPLRS Network Manager
ASAS	Network Manager Tool
AFATDS	TIMS
FAADC2 (AMDW/S)	ISYSCON
GCSS-A	RAPTOR

The recommended technical trainers also include two simulations that do not seem to precisely fit in the categories established above. These additional simulations are the:

- CHS Block 2 Assembly and Disassembly Simulation to train operators and leaders on computer components and functions (science). This simulation would replace the use of the "old" actual boxes currently being used for training.
- Satellite and Transmission Principles Trainer for training principles to operators and leaders. The updates for this trainer are included in the Operational Requirements Document (ORD) for the Defense Satellite Communication System (DSCS)-Training Device (TD) SATCOM Transformation Principles Trainer (STPT), approved on 21 January 1991 and reformatted on 4 January 2001.

3.2.4.1.2 Tactical Simulations

The recommended tactical trainers and their primary purposes are provided below.

Tactical Trainers	
Trainer	**Purpose**
Information Technology Fundamentals & Principles Tactical Trainer	Train leaders in signal and information technology fundamental and principles (art)
Information Technology Tactical Network Trainer	Train leaders to plan, establish, operate, protect and fight signal and information technology networks within the context of tactical scenarios (art)
Information Technology Tactical Adaptive Leader Trainer	Train adaptive leaders in a range of tactical scenarios and situations -- a computer generated leadership reaction course (art)
Reconfigurable TOC Trainer	Train leaders on different TOC configurations with emphasis on signal and information technology systems and networks operating in a range of tactical TOC configurations (art)
Visual Terrain Environment Trainer (immersive)	CAPSTONE exercises to validate leader skills to plan, establish, operate, protect, and fight signal and information technology systems and networks in support of tactical operations (art)

The filled-in sections in the following diagram illustrates University courses that are candidates to use the suite of recommended tactical trainers and simulations.
This illustration of multiple users across the Colleges reinforces the significant advantages described and highlighted in the earlier discussions for the common uses of trainers and simulations at the University.

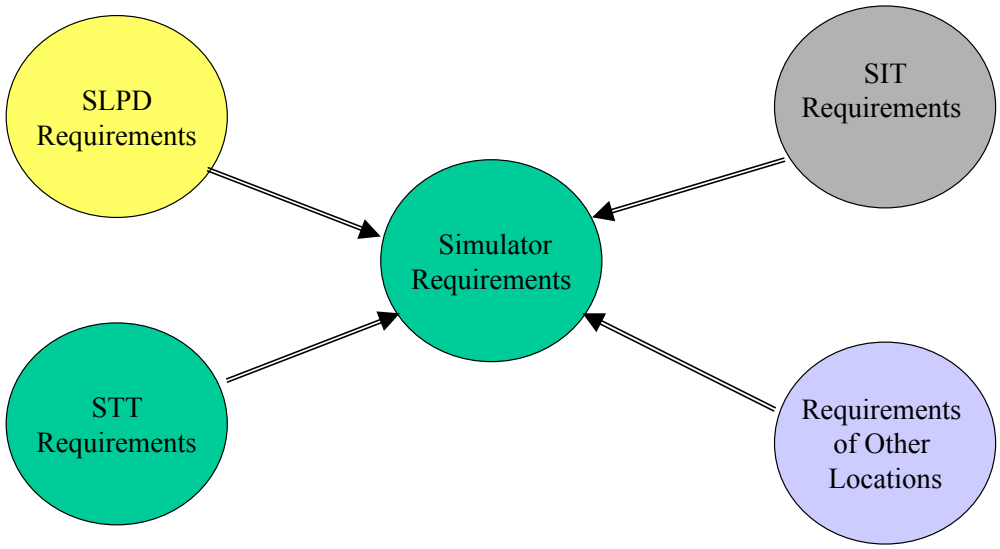
Trainer/Course	Fundamentals & Principles Tactical Trainer	Information Technology Tactical Network Trainer	Tactical Leader's Trainer	Visual Terrain Environment Trainer	Reconfigurable TOC Trainer
Network Fundamentals					
Transmission Fundamentals					
Joint/EAC Communications					
EBC Signal Operations					
Network Planning and Management Fundamentals					
ISYSCON Fundamentals					
TOC Simulation					
S-6 Fundamentals					
S-6 TOC					
SIGNAL PLATOON LEADER FUNDANMENTALS					
Tactical FTX					
Signal FTX					
SIPRNET, NIPRNET, and NES Fundamentals					
TACTICAL DEFENSE MESSAGE SYSTEM (DMS/TMS) Fundamentals					
DGM, MULTICHANNEL AND TECHNICAL CONTROL Fundamentals					
MOBILE SUBSCRIBER EQUIPMENT (MSE) Fundamentals					

3.2.5 Establishing Training Requirements

The significant levels of common use provides justification for developing and fielding the trainers and simulations, and is an important consideration that should be included in developing requirements for them. The model recommended for establishing the requirements of these trainers is illustrated below. This model is consistent with the earlier description of common users of University simulations. The following figure shows how the requirements from the different users can be integrated. Part of the training requirement analysis has to be a prioritization effort. The group as a whole, including the simulation developers and/or integrators, must take an appetite suppressant to ensure that the shared training requirements are included in the simulation requirement, and the resulting system meets the training needs at an affordable price. The research recommends that a series of Task Forces be formed to develop requirements for the trainers described above. These Task Forces should include representatives from each of the users, to include those at other locations, to provide input for the requirements. The product of these Task Forces would be University requirements for the recommended trainers and simulations.

These requirements should be consistent with the complementary relationships between simulations, part task trainers, hands-on-trainers, CBT/IMI and actual equipment illustrated earlier in the Training Triangle. In arriving at these requirements, it is essential that the Task Forces focus on what is required/needed, not what is possible to develop and field. It also is important for the participants understand it is not possible to train for everything, and that there will be a need to expect and accept the requirement for priorities and trade-offs. The requirements specify COTS and avoid the use of proprietary software.

Integration of Training Requirements



3.2.5.1 Simulation Design

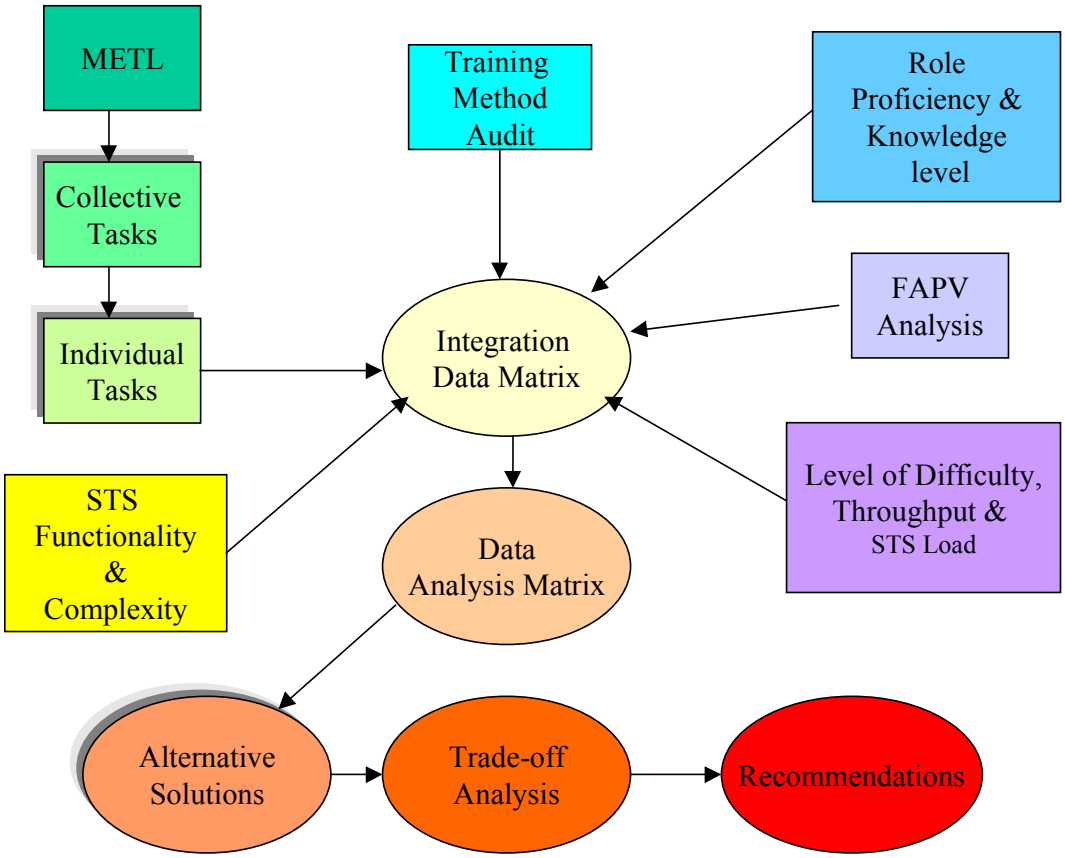
The designs for the simulations should:

- Support training for different MOSs (e.g., officer advanced, warrant officer, ANCOC, -10) as well as individuals and units located at other locations.
- Include the integration of growth such as adding tasks, functions, or other features as additional funding becomes available and/or new applications are identified.
- Support the use of PC based platform(s) available at the University and other locations as a design criterion. Every option, to include making trade-offs when necessary to keep applications on the lower cost platforms that are more widely available, should be explored. It is recommended that a conscious decision of the University's leadership be required before developing simulations for other than PC platforms.
- Include the simulation software residing on the user's PC platform and being able to use multiple simulation applications on the same platform. It is envisioned that the platform screen would display Icons such as a picture of the system for the different simulations. The user would select the appropriate Icon, load the program, and use the simulation for training.
- Establish and include the reuse of a common architecture across the trainers and the associated families of simulations; e.g.,
  - Instructor Operating Station
  - Fault insertion
  - Student tracking and record/AAR
  - Screen menu
  - Man-machine interface
- Establish and include quantifiable requirements to be used as "exit criteria" for simulation development to avoid requirement "creep"

3.2.5.2 Integrated Training System Analysis

The research recommends the University use the Integrated Training System Analysis model illustrated on the following page to develop its training strategy for tasks to be taught. This model integrates scientific and technology based methods with traditional ISD methodology for integrating advanced simulations and methods with traditional materials and methods, including CBT/IMI. The model recognizes that the basis of tasks to be taught is the Mission Essential Task List from which collective and individual tasks are determined is consistent with Army training doctrine described in FM 25-100, *Training the Force*.

The Integrated Training Systems Analysis Model



The data elements developed in the model are integrated in the data matrix illustrated below using the example of a 31S-10 task to install a satellite communications terminal taught in the School of Telecommunications Technology.

Data Integration Matrix Example for a Collective Task from the 31S-10 Course

Task: Install Satellite Communications Terminal AN/TSC-85B(V) & AN/TSC-93B(V)									
31S-10		Required	Traditional	CBT/IMI	HOTS	Mock-up	Tech Sim	Tac Sim	Equipment
Level 1 Audit			2	2	0	N	0	N	3
Role		P							
Proficiency Level		2							
Knowledge Level		B							
FAPV Level			F	F,A	A,P		P,V		V
Level of Difficulty			2	1	1.1	0	0.9	0	1.1
Students per Year			461	461	461	0	461	0	461
STS Load			76.833333	461	253.55	0	207.45	0	253.55

The analysis starts with a level 1 audit of training methods and materials presently being used to determine what is available, what can be used for instruction, and gaps that

should be filled. This audit results in the definition of the "Is" status of training methods and materials. The other steps of the model include:

- Identifying and integrating task performance roles the student must perform, the performance level that must be achieved to perform these roles, and the knowledge level the student must acquire to achieve these performance levels.
- Determining the level of complexity for each of the training means that are considered for completing this training; these levels include being familiar, acquiring, practicing, and/or validating (FAPV) the skills required for performing the task.
- Determining the level of difficulty for acquiring the required levels of skills. This level of difficulty can be defined in terms of the number of instructional hours needed for acquiring the required level of skills.
- Determining the number of students that have to be taught each year (throughput)
- Estimating an annual load for Student Training Stations (STS) that is based on the number of students per year and the level of difficulty for each task to be trained. This STS load is the data that provide the basis of the "Ought" recommendation representing the training strategy for the task.
- Identifying alternative solutions and conducting trade-off analyses among a set of viable alternative approaches.
- Making recommendations for the training strategy.

The information from the data integration matrix is analyzed in a data analysis matrix that provides an additional description and analysis of the task being trained, and the recommended training strategy. The final step includes establishing costs for implementing the training strategy.

3.2.6 Evaluating Learning

The University will need capabilities that support cost effective and scientific based evaluations without increasing the burden on students, instructors, trainers, units and institutions. These efforts should include building a knowledge base of best practices on effects of advanced technologies for learning and performance. Basic multimedia computer-based instruction has been demonstrated as a learning environment, but the University needs to explore how and when advanced technologies such as simulations, intelligent coaching, natural language interfaces, and avatars provide additional benefits to instruction. The efforts should include establishing a central facility to receive, process, and provide processed data to those responsible for conducting evaluations. Embedded instruments in training devices/courseware to collect and send evaluation data to the central facility for processing, and then return data to the User for analysis and use can be developed to support evaluations of learning.

The University will need to develop methods for certification of education and training at other locations as it moves to make the location less relevant. The use of simulations that have been tested and approved for performance based evaluations can be particularly useful tools for certifying training.

4.0 SERVICE SUPPORT

4.1 Trainer and Simulation

The primary service support focus of the research was to develop Rough Order of Magnitude (ROM) costs for the suite of trainers and simulations recommended in Sections 3.2.4.1.1 and 3.2.4.1.2 of this report and for the Simulation Resource Center described in Section 3.2.2.5. These ROMs provide the USASC&FG and the University a starting point for planning and discussions with funding sources. These ROMs should be further refined as implementation plans are developed and the training requirements and analysis recommended in Section 3.2.5 are completed.

The methodology used for developing these ROMs for technical trainers included determining:

- Complexity of the equipment to be simulated. RTI's experience with a range of technical simulations with varying levels of functionality such as its family of track vehicle maintenance trainers was used to provide a baseline value.
- The ultimate skill proficiency levels required for the soldiers and leaders from the training. For example, a warrant officer is not required to be a proficient operator of MCS, but should be familiar with the system and should understand the information and bandwidth requirements of the MCS and who will use it in a TOC.
- The range of skills that the simulation must support. For example, an ABCS simulation may support AIT training in networking and organizational maintenance, and leader training in TOC configuration, but not operator training
- The training phases to be supported by the simulation, including familiarizing, acquiring, practicing, and validating the skill.

The data and information obtained in the manner described above were used, in conjunction with an appetite suppressant, to make informed judgements of what needs to be simulated, as compared to what could be simulated, to achieve the required skill proficiency levels. These data were used to compare the complexity and the proficiency skill levels required to be achieved in the simulation. This information was used to make an experience based comparison with comparable simulations that have been developed by RTI and to use these comparisons for developing a ROM cost for the Trainer. Four levels of simulators are defined in the following table.

Complexity Level	Description
1	Simulation of a single communications component, such as the EPLRS radio. The simulation supports familiarization with the controls and the connectors, and includes the functionality required for the individual to determine whether the component has been connected to the network and power sources correctly
2	Functional simulator of a single communications component, such as a virtual computer. The simulation supports training on the component, its functionality and operations of the system, and enables the student to remove, replace and test system operations to verify they have been correctly replaced..
3	Simulation of a communication system such as echelon below corps systems for training operator and some maintenance tasks.
4	Simulation of more complex communication systems such as echelon above corps simulations for training operator and maintenance tasks.

Each trainer consists of a family of simulations. The designs establish and enforce the reuse of common architecture across the simulations in a family as a cost-saving approach. The reuse of components common to different simulations such as vehicle crew compartments and shelters, radios, encryption devices, and power boxes, also reduces costs. The efficient use of GFI, GFP, existing GOTS and COTS simulations, and review boards such as the Integrated Product Team for cost effectiveness..

The University can expect the first simulation to be more costly to develop than subsequent applications as it start to reap the benefits of common architectures and components, and other cost savings. The research factored a set of reasonable cost savings that are expected to be realized from significant levels of reuse across the suite of technical trainers and simulations.

4.2 Technical Trainers

The following sections describe the application of the methods described above. Each section includes a table showing the simulations included in the trainers. The columns identify the roles of the soldiers and leaders to be trained, using the definitions of the Integrated Training Analysis Model. Each cell of the table describes how the simulation will be used to train the specified roles in terms of the training phases: familiarization with a skill, acquiring a skill, practicing the skill, and/or validating the skill. This model assumes that the simulators will be used in conjunction with other training methods, and that other training methods may be used during the same phase of training. If a cell contains a capital F, A, P, V, then simulator is the primary method for training that phase for that role. For example, if a simulator is used as a primary method for familiarization

for a supervisor, then a capital 'F' will appear in the supervisor column. If a simulator is used as a secondary validation method in combination with live equipment for validation of a primary operator, then a lower case 'v' will appear in the primary operator column. A simulator may be used for multiple phases of training. For example, if 'F,A,P,v" appears in a cell, then the simulator is a primary method for familiarization, skill acquisition, and skill practice, and is a secondary method for validation. It should be noted that raising any of these proficiency levels will normally increase the training requirements of the simulation with an accompanying increase in the cost of developing it, and could increase the life cycle cost for the simulation.

4.2.1 Echelon Below Corps Trainer

	Primary Operator & User	Secondary Operator	Supervisor	Planner & Manager	Organizational Maintainer	Direct Support Maintainer	Level of Complexity
Echelon Below Corps Trainer							
AN/TTC-47	F,A,p,v		f	f	F,A,P,v	F,A,P,v	**3**
AN/TTC-46	F,A,p,v		f	f	F,A,P,v	F,A,P,v	**3**
AN/TTC-48	F,A,p,v		f	f	F,A,P,v	F,A,P,v	**3**
AN/TRC-190	F,A,p,v		f	f	F,A,P,v	F,A,P,v	**3**
AN/TRC-191	F,A,p,v		f	f	F,A,P,v	F,A,P,v	**3**
AN/TTC-51 (Ft. Bragg)			f	f			
AN/TTC-50 (Ft. Bragg)			f	f			
AN/TSC-154 SMART-T	F,A,p,v		F	F	F,A,P,v	F,A,P,v	**3**
AN/TSC-156 (V)* STAR-T	F,A,p,v		F	F	F,A,P,v	F,A,P,v	**3**
AN/VSQ-2C(V)1 and AN/TSQ-158 (V)4. (EPLRS System)	F,A,p,v		f	f	F,A,P,v	F,A,P,v	**2**

For Echelon Below Corps trainers, simulators are expected to be the primary methods for familiarization, skill acquisition, and skill practice for the operator, organizational maintainer, and DS/GS maintainer roles. They will also support familiarization for supervisors and planners/managers. It was noted during the research that the AN/TTC-51 and AN/TTC-50 are used only at Ft. Bragg and may not be a high priority because of the low density of soldiers and leaders using this system. Additionally, it was noted that AN/TSC-156 (V) STAR-T is a new system and it may be possible to work with the PM to fund the development of this simulation in lieu of new equipment. Finally, it was determined that additional new equipment items are programmed for delivery to the USASC&FG to support AN/TTC-154 (SMART-T) training. It may be possible to reduce the number of end items delivered and use the savings for developing hands-on-trainers and software-based simulations.

4.2.2 Echelon Above Corps Trainer

The research recommends the eight simulations identified below for inclusion in the Echelon Above Corps Trainer. Each of these simulators has been identified as a level 4 trainer in terms of complexity of the equipment and the number of training missions as show in the table below. It was noted during the research that the AN/TRC-170, the TD1233, TD-1234, TD-1235, and the CV-4180 are joint communications systems used for SLPD leader training and may not be a high priority because of the low density of students using these systems. As a result, ROM costs were not developed for these simulations.

	Primary Operator & User	Secondary Operator	Supervisor	Planner & Manager	Organizational Maintainer	Direct Support Maintainer	Level of Complexity
Echelon Above Corps Trainer							
AN/TRC-173	F,A,p,v		f	f	F,A,P,v	F,A,P,v	4
AN/TRC-174	F,A,p,v		f	f	F,A,P,v	F,A,P,v	4
AN/TRC-175	F,A,p,v		f	f	F,A,P,v	F,A,P,v	4
AN/TRC-138	F,A,p,v		f	f	F,A,P,v	F,A,P,v	4
AN/TRC-170 (USAF)			f	f			
AN/TSC-85	F,A,p,v		f	f	F,A,p,v	F,A,p,v	4
AN/TSC-93	F,A,p,v		f	f	F,A,p,v	F,A,p,v	4
AN/TTC-56	F,A,p,v		F	F	F,A,p,v	F,A,p,v	4
TD-1233, TD-1234, TD-1235			f	f			
CV-4180			f	f			
TTC-39D/PS/39D(V)2	F,A,p,v		f	f	F,A,p,v	F,A,p,v	4

4.2.3 Integrated Digital Systems Trainer

The Trainer does prepare the student with the skills for operating and maintaining communications equipment, including the EPLRS Network Manager, the Network Manager Tools, TIMS, ISYSCON, and RAPTOR to establish, operate and maintain the networks necessary for the individual systems to operate as an integrated Army Battle Command System.

	Primary Operator & User	Secondary Operator	Supervisor	Planner & Manager	Organizational Maintainer	Direct Support Maintainer	Level of Complexity
Integrated Digital System Trainer							
MCS		F,A,p,v	F	F			1
MCS Light		F,A,p,v	F	F			1
ASAS		F,A,p,v	F	F			1
AFATDS		F,A,p,v	F	F			1
FAADC2 (AMDW/S)		F,A,p,v	F	F			1
FBCB2		F,A,p,v	F	F	F,A,p,v		2
GCSS-A		F,A,p,v	F	F			1
TAIS		F,A,p,v	F	F			1
CSSCS		F,A,p,v	F	F			1
SINCGARS		F,A,p,v	F	F	F,A,p,v		2
EPLRS Network Manager	F,A,p,v			F,A,p,v	F,A,p,v		2
Network Management Tool	F,A,p,v			F,A,p,v	F,A,p,v		2
TIMS	F,A,p,v			F,A,p,v	F,A,p,v		2
ISYSCON	F,A,p,v			F,A,p,v	F,A,p,v		2
RAPTOR	F,A,p,v			F,A,p,v			2

4.2.4 Other Trainers

The CHS Block 2 Assembly and Disassembly Simulation is used to train operators and leaders on computer components and functions. This simulation, with level 2 complexity, would replace the use of the "old" actual boxes currently being used for training.

	Primary Operator & User	Secondary Operator	Supervisor	Planner & Manager	Organizational Maintainer	Direct Support Maintainer	Level of Complexity	
Other Trainers								
Satellite and Telecommunications Principles Trainer	F,A,p,v				F,A,p,v	F,A,p,v	4	
CHS-2 Computer Assembly and Disassembly Trainer			f	f	F,A,p,V	F,A,p,V	2	

Some of the training functions currently being taught on this Trainer could be shifted to other simulations, then the potential exists to reduce its training load. However, this level 1 research does not provide the information required to make a reasonably sound, knowledge based recommendation for the Satellite and Transmission Principles Trainer.

4.3 Tactical Trainers

The complexity level of these simulations, with the exception of the virtual Reconfigurable TOC Trainer, is 2. It also is considered feasible for the University to use and/or adapt existing trainers and terrain databases to meet many of the tactical training requirements for its students. Consequently, the associated costs of these trainers, keeping in mind the use of "what needs to be trained" and not "what is possible" as a criterion for selecting these trainers, should be reasonable.

Trainer	Purpose	Complexity
Information Technology Fundamentals & Principles Tactical Trainer	Train leaders in signal and information technology fundamental and principles	**2**
Information Technology Tactical Network Trainer	Train leaders to plan, establish, operate, protect and fight signal and information technology networks within the context of tactical scenarios	2
Information Technology Tactical Adaptive Leader Trainer	Train adaptive leaders in a range of tactical scenarios and situations; a computer generated leadership reaction course	2
Reconfigurable TOC Trainer	Train leaders on different TOC configurations with emphasis on signal and information technology systems and networks operating in a range of tactical TOC configurations	3
Visual Terrain Environment Trainer (immersive)	CAPSTONE exercises to validate leader skills to plan, establish, operate protect, and fight signal and information technology systems and networks in support of tactical operations	2

4.4 Simulation Resource Center

The Simulation Resource Center

- Equipment to establish two simulation servers/databases (one for the Tactical Trainers and one for the Technical Trainers) and the 24/7 Help Desk.
- Annual cost of two technicians to manage, maintain, and distribute the simulation software.
- Annual cost of six staff members to operate the 24/7 Help Desk

4.5 Contracting Vehicle

The research recommends the USASC&FG and the University establish an Omnibus IDIQ contract with multiple primes, each with a team of subcontractors, specifically to support the contracts that will be required to support this masterplan. The TRADOC Doctrine IDIQ contract managed by the TRADOC Acquisition Center (TAC) is a model that can be adapted to meet the needs of the USASC&FG and the University. Until this contract is in place, it should be possible to use existing mechanism such as the TRADOC Doctrine IDIQ contract managed by the TAC or the STOC Omnibus contract managed by Army STRICOM to support the masterplan.

5.0 COMMAND AND SIGNAL

The USASC&FG is conducting an internal study that is examining a range of alternative organizational models for implementation. The research completed by RTI did not address these models, except to conclude the University and its education and training models being recommended in this report are consistent with the organizational models being considered by the USASC&FG.

RTI recommends the USASC&FG include the organizational model selected in this section of the masterplan.

6.0 ROADMAP

This section includes research recommendations and recommendations for funding and managing the implementation that, together, represent a level 1 roadmap for realizing the Information Technology and Digital Training Masterplan.

6.1 Research Recommendations

The research recommendations are organized in three major sections: University of Information Technology, Education and Training Model, and simulations.

6.1.1 University of Information Technology

The research recommends the USASC&FG establish the University of Information Technology described in Section 3.2.2. This recommendation includes:

- Organizing the University as the professional "home" for signal and information technology soldiers, leaders and their families to:
  - Facilitate and foster lifelong professional and personal relationships
  - Provide 24/7 lifelong learning, materials, information, and support to the signal and information technology community
  - Assume the same responsibility for all students, regardless of their location
- Establishing remote campuses as a complement to distant learning capabilities to provide University presence and sponsored education and training in locations that have higher concentrations of signal and information technology soldiers and leaders.
  - Use USASC&FG activities at Ft Hood and Ft Lewis as prototypes for other locations such as Ft Bragg
- Establishing relationships with academia and degree accreditation programs
- Sponsoring education and training research and publications
  - Establish award recognition programs for successful research and publication
- Establishing an omnibus IDIQ contract vehicle/mechanism for supporting University requirements. Until this contract is available, it recommended the USASC&FG use vehicles such as those described in Section 4.5.

6.1.2 Education and Training Model

The research recommends the USASC&FG adopt the Education and Training Model described in Section 3.2.3 for getting trained soldiers and leaders to the field faster and supporting follow-on assignment education and training requirements. It also recommends the USASC&FG conduct pilot(s) of the model to obtain data and lessons learned. Candidate pilot(s) include:

- Assignment oriented training (MOS 31S, 31R and/or Officer Advanced course)
- Increase use of interactive PC based simulations to support "learning by doing
- Expanded COTS training (MOS 53)
- Trading off equipment for simulations (Smart-T)
- Assignment oriented training for follow-on assignments

6.1.3 Simulations

The research recommends the USASC&FG adopt simulation capabilities as the basis for realizing "learning by doing". The recommendations include:

- Developing a family of technical and tactical simulations to provide more realistic and better education and training at less cost at the university and other locations
- Establishing complementary relationship between simulations, PTTs, HOTs, CBT/IMI, and actual equipment
- Focusing on what is required/needed; not what is possible
  - Understand/accept it is not possible to train for everything
  - Expect/accept need for priorities and trade-offs
- Avoiding the use of proprietary software; specify COTS
- Designing the simulation to support:
  - Different MOSs (e.g., officer advanced, warrant officer, ANCOC, -10)
  - Training for individuals and units at other locations
  - Growth as additional funding becomes available and/or new applications are identified
- Targeting PC based platform(s) available at the university and other locations
  - Multiple applications on same platforms
  - Make trade-offs when necessary to keep applications on lower cost platforms that are more widely available
- Establishing and reusing a common architecture across the family of simulations; e.g.,
  - Instructor Operating Station
  - Fault insertion
  - Student tracking and record/AAR
  - Screen menu
  - Man-machine interface
- Establishing and enforcing quantifiable requirements to be used as "exit criteria" for simulation development and to avoid requirement creep.

6.2 Funding

There are a number of options to prioritize the simulations and develop them in order of the priority list, as funding becomes available. Another example of an option is to design simulations that cost less, but have growth designed within them that can be added, as funding becomes available. There also is the option of convincing those who make budget decisions to provide the funding for some or all of these ROMs.

The Implementation Task Forces will need to be creative and imaginative in their consideration of potential "outside the box" funding sources and include these sources in their action plans. For starters, the Implementation Task Forces could group the action items by different funding levels and funding sources. For example, it may be possible to implement some action items with locally approved changes to USASC&FG policies and procedures with little or no cost. One example of such an action item would be

University sponsorship for research and publication with award recognition given by the Chief of Signal to outstanding efforts.

It also may be possible to redirect existing funding by making internal changes to the current way of conducting business. Other potential sources of resources that may be identified, explored and mined include:

- Leveraging education and training services provided to the other military services and joint organizations and agencies as well as high priority Army programs such as USASC&FG training being provided to III Corps and to the signal company of the Interim Combat Brigade. The III Corps DTF is yet another example of a high priority program that could result in mutually advantageous relationships.
- Working with PMs to have simulations developed and delivered to support training vice actual pieces of equipment
- Trading off funds programmed for traditional training materials, devices, and/or equipment for simulations; an example could be the programmed SMART-T vehicles
- Identifying and using simulations available at other locations, particularly tactical simulations and databases. There are a number of simulations that may be adapted for use in the University and these should be identified and evaluated against established criteria such as those described in Section 6.3.2.
- Obtaining buy-in and support of field units and other organizations
- Using University education and training facilities and/or materials for other than DoD students such as those attending civilian academic and technical training centers. The U.S. Army's National Guard contracting of distance learning classrooms to commercial firms is an example of generating revenue by leasing Government owed facilities.

The funding required that is beyond the budget and program will not "just happen" and all of it may never be obtained. While outside the "business as usual box", a well prepared, coordinated plan with integrity, that is supported by the Command Group and that is aggressively pursued can be expected to secure substantial additional funding. Furthermore, determination and demonstrated success can be expected to result in greater levels of support among decision-makers and lead to more success. The research convincingly concludes that the demonstrated energy, intelligence, and dedication of the signal and information technology community provides a solid basis for pursuing entrepreneurial like, out-of-the-box funding strategies with a high level of assurance for success. Indeed, these successes are expected to create higher levels of excitement and determination to succeed across the community.

6.3 Managing the Implementation

6.3.1 Executive Steering Committee

The research recommends that an Executive Steering Committee be formed to provide oversight for the implementation of the masterplan. The members of the Executive Steering Committee should understand the vision and potential, and include those responsible for implementing the masterplan. Candidate members include

representatives of the USASC&FG Command Group, the University, and reserve components, as well as signal and information technology field units. Consideration also should be given to including representatives from academia and industry on the Committee. It is suggested that the full Executive Steering Committee formally meet semi-annually to review plans and progress, and to make recommendations, perhaps, during Regimental Week and during the Fall Symposium.

6.3.2 Implementation Task Forces

Remembering the "devil is in the details", the research recommends the USASC&FG form functional Implementation Task Forces to prepare Implementation/Action Plans that include bite size chunks that result, over time, in accomplishing the masterplan. These action plans should identify specific actions to be accomplished, assign lead and supporting responsibilities, and specify milestones/timelines for completing each action. The candidates for Implementation Task Forces are provided below.

Implementation Task Forces		
Task Force	**Develop Implementation/Action Plan to**	**Chair**
University of Information Technology	Establish University with colleges, remote campuses, relationships and programs with other academic/research organizations, sponsored research/publication programs, 24/7 Help Desk and Simulation Resource Center	Directorate of Training
Education and Training Model	Implement model, to include conducting prototypes	Office, Chief of Signal
Technical Trainers and Simulations	Determine education and training requirements for trainers and simulation	STT
Tactical Trainers and Simulations	Determine education and training requirements for trainers and simulation	SLPD
Resources and Facilities	Provide resources, facilities, establish omnibus IDIQ contract	Resource Management

In addition to membership from the USASC&FG and its schools, the research recommends these Implementation Task Forces include representatives from the reserve components, remote sites such as Ft Hood, TX, and major Signal and Information Technology units, organizations, and agencies. The representatives from beyond the USASC&FG are considered particularly critical for including the needs and concerns of the larger community being served by the University. Additionally, this larger membership supports developing "real" partnerships with the field.

The realization of the Information Technology and Digital Training Masterplan with the University of Information Technology, a new education and training model, and the use of simulations as the basis for learning is not isolated to the USASC&FG. It is a major undertaking that involves the participation and support of outside agencies such as HQ TRADOC, HQ DA, as well as FORSCOM and many of its units. These Implementation Task Forces should identify action items such as student assignment policies and

procedures, funding formulas that recognize education and training provided by the University at other locations, and new certification policies and procedures for lifelong learning. The identification of these action items should include the outside organizations and agencies that have to support the implementation plans and recommendations for involving/working with them for successful implementation.

The Implementation Task Forces for Technical and Tactical Trainers/Simulations should occur in phases. In Phase I, the Task Forces should use the model described in Section 3.2.5 for developing the simulation requirements. The Task Forces also should use an established set of criteria for defining and recommending trainers and simulations; examples of criterion include:

- Supports training for multiple MOSs
- Can be supported on PC platforms
- Is COTS based
- Supports growth
- Can be used at other locations
- Is consistent with a common architecture
- Complements other training materials (CBT/IMI, PTTs. HOTs, actual equipment)
- Development, article, and life cycle costs

The Task Force also should develop preliminary simulation design for the information described in Section 3.2.5.1. This preliminary design will be finalized with the support of a Government Integrated Product Team (IPT) in Phase II. The Phase I resulting document provides information needed for defining and justifying the trainer/simulation and funding for developing, fielding, and life cycle operations. The deliverable for Phase I would be a training requirement document that includes, as a minimum, the information in the matrix below.

Phase I Training Requirement Document	
Content	**Examples**
Students/users and tasks to be trained	MOSs; operator, maintenance and network tasks
Fundamentals and Principles to be trained	Radio and micro wave prorogation
Delivery method and locations	Web-based, internet
Certification	Levels
Operating modes	Training, testing, refresher
Learning environments to be used	Classrooms, units, individual locations
Simulation design	PC, COTS, reuse
Costs	Development, life cycle, trade-offs

The Implementation Task Force completes the preliminary simulation design developed during Phase I and the training strategy described in Section 3.2.5.2 during Phase II. This work may occur as part of a contract and include a formal Government IPT. It is

recommended that the Task Force and/or IPT use a tool such as the Integrated Training System Analysis Model described in Section 3.2.5.2 to develop the detailed training strategy for each trainer/simulation. The data and training strategy developed in this model can provide the basis of Request for Proposals to contracting agencies such as the TRADOC Acquisition Agency or STRICOM for the simulations. It may be advisable to complete some of the Phase II analyses for higher priority simulations before funding is approved and available. Conversely, it may be most appropriate to wait until funding is approved for others. These are decisions that are best made on a case by case basis.

It is anticipated that, in Phase III, the Implementation Task Forces would provide the nucleus of the University representatives on the Government's IPT to provide oversight for the developing, fielding, and managing the life cycle of the trainers and simulations. The IPT should also include the contractor responsible for implementing and/or integrating the trainer/simulation.

7.0 SUMMARY

This report has provided a level 1 analysis and recommendations for the Information Technology and Digital Training Masterplan for the USASC&FG. The implementation of the masterplan is long term undertaking that should proceed in bite size chunks as technologies and methodologies mature and become available, as funding and other resources are made available for its implementation, and as the culture evolves to embrace it. The masterplan is a living document that, undoubtedly, will have to be adapted over time to accommodate changing realities, circumstances, and the vision of future signal and information technology leaders. The design includes the flexibility required for such adaptations. Finally, the USASC&FG will be revolutionizing education and training for the signal and information technology community as it moves along this roadmap and, with leadership support, become a rallying point of pride for the University and the community it serves.